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G.S. Publications
279

Notified in
A.C.I.s. for the
week ending
6th March
1940



Small Arms Training

Volume I, Pamphlet No. 7, Part 1—1939

.303-inch Machine Gun

SUPPLEMENT

(The Clinometer and Bar Foresight)

1940

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ii.

iii.

By Command of the Army Council,

R. G. G.

THE WAR OFFICE,
1st March, 1940

AMENDMENTS TO S.A.T., VOL. 1.

PAMPHLET NO. 7, PART I, 1939.

GENERAL NOTE.—Until dial sights are issued, training will be carried out in the use of the clinometer, bar foresight, etc. The following lessons will be substituted.

1.—Page 52, insert New Lesson.

"LESSON 30A—BAR FORESIGHT.

Instructor's Notes.

Stores—Gun, tripod, bar foresight.
Explain and demonstrate the following:—

1. The graduation on the bar, the pointers, and the markings R. and L.
The graduations on the upper surface of the bracket.
The sliding sight and clamp screw.
The clamping screw on the bracket.

2. To affix the bar foresight.
Gun mounted, No. 2 kneeling on the right of the gun with bar foresight in pouch, slung over left shoulder.

No. 2 will remove the bar foresight from the pouch, seeing that it is set at zero. He will place it over the foresight protecting wings of the gun, and, being careful that the spring stud engages on the opening on the right wing, will tighten up the clamp screw on the bracket.

3. To lay off an angle of direction with the bar foresight.
Gun mounted, with bar foresight, affixed, and laid on an aiming mark. No. 2 at the gun.

No. 2 will adjust the bar foresight in accordance with the deflection given.

It should be noted that the sight is moved in the opposite direction to that ordered, i.e., if right is ordered the sliding sight is moved to the left.

Adjustments will be made to the nearest 10 minutes. When the bar foresight is replaced in its pouch, it will be set at zero."

2.—Page 52, insert New Lesson.

"LESSON 31A—THE CLINOMETER.

Instructor's Notes.

Stores—Gun, tripod, clinometer.
Explain and demonstrate:—

1. The graduations on the cradle and micrometer collars. Method of adjustment by milled head and quick release. The arrow on the base.

2. To place elevation or depression on the gun by means of the clinometer.

Gun mounted approximately level. No. 2 kneeling on the right side of the gun, clinometer in case, set at zero, slung over the left shoulder.

No. 2 removes the clinometer from its case and sets it at the angle ordered. He places it, with the arrow to the front, on the side plates of the breech casing of the gun. It should be placed so as not to foul either the trigger bar level, or the tail of the trigger. By moving the hand wheel, No. 2 centralizes the spirit bubble.

The clinometer will be set at zero when it is no longer required. At other times it will be left at the setting ordered. Elevations will be given to the nearest five minutes.

3. To ascertain the quadrant elevation on the gun.

Gun mounted and laid at any angle of elevation or depression. No. 2 kneeling on the right side, with clinometer set at zero.

No. 2 places the clinometer on the side plates of the breech casing, arrow pointing to the front. He turns the milled head until the bubble is central, removes the clinometer and takes the reading."

3.—Page 57, insert New Lesson.

"LESSON 37A—AIMING POST AND ZERO POST.

MARK 1.

Instructor's Notes.

Stores—Gun, tripod, bar foresight, aiming post, zero post.

1. AIMING POST, MARK I. (Mark III. is described in Lesson 37).

(i.) Explain and demonstrate:—

The telescopic portion.

The collar on the inner rod.

The bracket.

That when used in conjunction with the clinometer and bar foresight, an aiming post is required for each gun.

(ii.) To plant the aiming post when used with bar foresight.

The gun will be mounted and laid with any quadrant

angle. The bar foresight will be affixed. No. 1 at the gun, No. 3 a few yards in rear with aiming post.

No. 1, without moving the gun, runs the tangent sight up to 2,500 yards (this range applies either for a Mark VII. or a Streamline back sight leaf). No. 3 moves up to the gun and looks over the sights to ascertain the approximate position for the aiming post. He will then plant the post not less than 5 yards in front. No. 1 will direct No. 3 by signal to move the post until the line of sight is at 6 o'clock on the aiming mark.

(Mark I. Aiming Post.) No. 3 should place the aiming post on the ground, or plant it vertically. If this is not possible, the foot of the post should be driven firmly into the ground sufficiently far to one side to admit of full use being made of the telescopic portion.

(Mark III. Aiming Post.) No. 3 should lay the post on its side, with the flat side of the base and the securing extension on the ground. If this is not possible, he will plant it vertically, making final adjustment with the folding arm.

2. ZERO POST.

For description, see Lesson 37, 2.

To plant zero post.—

Gun mounted and laid with any quadrant angle, bar foresight affixed. No. 1 at the gun, No. 3 a few yards in rear with the zero post. The instructor may act as the No. 1.

Nos. 1 and 3 act in the same manner as when planting the aiming post.

The zero post will be placed so that the line of sight is on the point where the ring joins the stem. If it cannot be planted upright it will be planted leaning sideways."

4.—Page 58, insert New Lesson.

"LESSON 38A—NIGHT AIMING AND USE OF AIMING LAMP.

Instructor's Notes.

Stores—Gun, tripod, night sights, aiming post, night aiming lamp.

1. NIGHT AIMING.

(i.) Description of night sights.

(a) The night sights are carried in the aiming lamp box.

(b) Explain the method of attaching the night foresight.

- (c) Explain method of attaching, and features of, the night backsight.
- (ii.) To lay an aim with the night sights.
 - (a) Instruction in aiming with the night sights will be carried out in the sequence given in Lesson 29, 3, i. to iii. The aim with night sights will always be taken at a bull's eye.
 - (b) The No. 1 will be taught to place the forefinger of the left hand on top of, and at the right side of, the back sight. This is necessary in order to shut out light from the lamp over the top and between the back sight and the stem of the tangent sight. To lay a correct aim, the flat top of the blade which projects from the lower edge of the rectangular slit in the centre of the foresight will be used. The other features on the foresight may be ignored.
- (iii.) To correct the line of sight.

No. 1 will make the necessary correction on the hand wheel and will then realign the sights by sliding the tangent sight up and down.

2. USE OF THE NIGHT AIMING LAMP.

- (i.) There are two types—Mark II. and Mark III.
If the Mark III., which is described in Lesson 38, is in use, in combination with the clinometer, bar foresight, and night sights, one night aiming box is required per gun.
The Mark II. box contains two aiming lamps, so that one box is required per two guns.
- (ii.) Description of the Mark II. lamp and box.
The folding handle on the side of the box must be opened before the box is opened. In removing the lamp it is necessary to take the lamp in one hand and the cable in the other to prevent the lamp being jerked and the connections carried away. In replacing, the word "TOP" on the lamps does not refer to their position in the box. Projecting strands of wire must not touch any terminal other than the one to which they are attached. No wire should touch terminals of the spare batteries.
- (iii.) In paying out the cables from the drums:—
 - (a) Speed should not be attempted.
 - (b) Both should be unwound together.
 - (c) No loose coils of cable should be allowed to loop round the ends of the drum.
- (iv.) Method of attaching the lamp to the aiming post.

- (v.) Lighting, dimming and extinguishing the lamps.
 - (a) The method of using the switch.
 - (b) The switch must be turned off before the lamps are replaced in the box."

5.—Page 63, insert New Lesson.

"LESSON 40A—SLIDE RULE, M.G., Mk.1.

Instructor's Notes.

Stores—Slide Rules.

1. Description.—

The following scales, etc., are engraved on the slide rule:

- (a) Safety angle scale.
- (b) Degree scale—graticule card.
- (c) V.I. and H.E. scale.
- (d) Wind scale.
- (e) Barometer and temperature scales.
- (f) 1 in 20,000 scale, showing yards.
- (g) 1 inch to 1 mile scale, showing yards.
- (h) Degree scale similar to that on the service protractor.
- (i) Range Tables.

(a) Safety angle scale.

Engraved on the rule is a Range to Target scale marked in hundreds of yards from 600 to 2,800, and opposite to this on the slide is a Range to Troops scale marked in black from 600 to 2,000 yards and in red from 500 to 100 yards.

The safety angle scale is used in accordance with the instructions laid down in Lesson 126 for which purpose a cord 24 inches in length is attached to the top of the slide rule.

Care must be taken that this cord does not become knotted and is exactly the correct length.

(b) Degree scale—graticule card.

The slide is marked with a degree scale opposite the top of the slide, and an arrow on the slide which can be used for graticule purposes in conjunction with the cord attached to the slide rule.

To use—as for Mk.III.

(c) V.I. and H.E. scale.

A V.I. scale marked in hundreds of yards from 300 to 10. In conjunction with this is an H.E. scale marked in hundreds of yards from 3,000 to 100, and a degree scale marked from 0 degrees to 10 degrees.

An arrow marked on the slide enables angles to be read off in conjunction with the V.I. and H.E. scales. To use—as for Mk.III.

(d) Wind scale.

On the reverse side of the slide are marked allowances for a 20 m.p.h. wind. The allowance for a side wind is shown on one side and marked from 115 minutes to 10 minutes, and on the other side in the allowance for head or rear winds marked from 90 minutes to 5 minutes.

A wind pointer is provided in the centre of the top cut-away portion on the back of the rule.

To use.—Place the "Wind" arrow on the slide opposite the "Range to Target." Turn the slide over and read appropriate allowance against the wind pointer.

(e) Barometer and temperature scales.

On the reverse side of the slide is also marked the allowance for 1 inch of barometer from 5 minutes to 25 minutes.

Allowance for 20% of temperature is also marked from 5 minutes to 35 minutes.

A pointer is provided in the centre of the bottom cut-away portion on the back of the rule.

To use:—Similar to wind method using "Temp. and Bar." arrow.

(f) 1/20,000 scale.

This scale is shown in divisions of 50 yards, and larger divisions mark the hundred, five hundred and thousand yards. The thousand marks are numbered in full.

(g) 1-in. to 1 mile scale.

This scale is marked in divisions of one hundred yards each and the larger divisions are one thousand yards.

(h) Degree scale—protractor.

In the centre of the sloping side is a protractor degree scale marked from 0 degrees to 90 degrees and used in conjunction with the 0 on the other sloping side of the rule.

(i) Range Tables.

On the back of the slide are marked the following extracts from the Range Tables, 1931. (The details

shown may vary slightly with those in Range Tables, 1939, but are sufficiently accurate enough for normal occasions.)

Tangent angles.

Angles of descent.

Length of beaten zones and cones.

Position of lowest shot below centre of cone.

2. Practice Squad."

6.—Page 66, insert New Lesson.

"LESSON 42A—TESTING AND ADJUSTING THE CLINOMETER.

Instructor's Notes.

Stores.—Gun, tripod, clinometer.

1. TO TEST THE CLINOMETER.

- (i.) Set the scale at zero.
- (ii.) Place the clinometer on the gun, elevate or depress until the bubble is in the centre of its run.
- (iii.) Reverse clinometer and note position of the bubble.
 - (a) If central, the clinometer is in adjustment, but confirm at, say, 10 degrees depression and 10 degrees elevation.
 - (b) If displaced, this indicates that an error is present.
- (iv.) In the case of (b) leave the clinometer on the gun and rotate the minute scale until the bubble is again central, then note the scale reading.
- (v.) Having noted the variation from zero, halve it and set the scale to this point, e.g., suppose that the reader points to 20 minutes E, remove clinometer and set scale to 10 minutes E.
- (vi.) Replace on the gun and proceed as in ii. and iii. above; if the bubble does not come central repeat the process.

NOTES.—

- 1.—When rotating the minute drum always turn to the left last, i.e., anti-clockwise. Should an error be found, it will be seen that when the clinometer is truly horizontal there will be a variation in the zero reading. This error will be noted and the instrument adjusted as soon as possible.

2.—If a gun is levelled with a clinometer known to be in adjustment, then any number of clinometers can be tested by placing them on the gun in the ordinary way and noting if there is any error.

2. TO ADJUST THE CLINOMETER.

Set the clinometer at the error noted. With the spanner loosen the "nuts securing micrometer collar," set the scale to zero and tighten up.

If the variation is large, it may be necessary to reset the degree reader. This is done by loosening the two securing screws and sliding the reader to the right or left, and then clamping up.

NOTE.—Except in an emergency, adjustments will be carried out only by armourers."

7.—Page 67, insert New Lesson.

"LESSON 43A—TESTING THE No. 9 MK.I DIRECTOR FOR ANGLE OF SIGHT.

Instructor's Notes.

Stores.—Gun, tripod, dial sight, director.

1. Mount a gun, attach a dial sight known to be in adjustment, and lay with the tangent sight at zero (0) on a distant object. With the range drum of the dial sight at zero, level the bubble by means of the angle of sight drum and note the reading.

Mount the director at the same height as the gun (i.e., object glass on the same level as the tangent sight) and take angle of sight to distant object.

If this is the same as the reading on the angle of sight drum the director is in adjustment. If not, note the amount of error.

2. If a horizontal line is available (see para. 3 below), place the object glass at one end of the horizontal line and take the angle of sight to the other end. If this is zero the director is in adjustment; if not, note the error.

3. TO LAY OUT A HORIZONTAL PLANE, AND TEST DIRECTOR FOR ANGLE OF SIGHT.

(i.) Select a position where there are two walls or upright posts, about 200 yards apart, and as far as possible in the same horizontal plane.

(ii.) Take director to one wall (A), if possible a corner of a house. Lay director at the other wall (B), and direct an assistant to make a mark on (B),

which appears to have no angle of sight (i.e., an angle of sight of zero).

Make a mark on (A) level with the object glass.

(iii.) Take director to (B), mount it with object glass level with the mark, and lay it at mark on (A).

(a) If mark on (A) has no angle of sight, the two marks are on the same horizontal plane and the director is in adjustment.

(b) If the mark on (A) appears to show an angle of sight, make a second mark which has not.

(c) By measurement, make a third mark (X) on (A), midway between the two existing marks. (X) is on the same horizontal plane as the mark on (B).

(iv.) (a) Any director may now be tested for angle of sight and the errors, if any, noted.

(b) Adjustments will only be made by an armourer.

4. Practice squad.

NOTE.—Where an adjustment is necessary, it will be carried out by an armourer."

APPENDIX I.

8. DESCRIPTION AND TESTING OF INSTRUMENTS
USED IN CONJUNCTION WITH THE .303-IN. VICKERS
MACHINE GUN.

1.—Foresight, bar, deflection, Mark I.

(Plate I.)

The sight is of steel and consists of:—

- (i.) A bar (A) about 10 inches in length, graduated in intervals of 10 minutes and degrees up to 7 degrees right and left of the centre line.
- (ii.) An inverted U-shaped bracket (B) to which the bar is a fixture and which is arranged to assemble over the projecting wings of the ordinary gun foresight, where it is secured by a screw (C) in the left side of the bracket and a spring stud (D) in the right, the former engaging in the hole in the left wing and the latter in the opening in the right wing.
- (iii.) The sliding sight (F) with clamp screw (G) for fixing in any desired position on (A).

The sight has a central blade and protecting wings, and is arranged to take night sights when required for night firing.

Two pointers (H) are provided on the slide to register respectively with the scale on (A) and on (B).

When assembling the sight, care must be taken that excessive pressure is not applied to the screw, as such will distort the sight protecting wings of the gun, and thereby affect the level of the bar.

2.—Post, aiming, M.G., Mark I.

The aiming post consists of a single telescopic stand, the top half of which can be raised or lowered.

The base of the stand is a metal plate with three spikes. The plate enables the spikes to be pushed into the ground by means of the feet, and also prevents the stand sinking too far in soft ground.

The lower half, or tube, of the aiming post has a clamping screw at the top which allows the top half to be fixed at the required extension.

The top half, or inner rod, is surmounted by a bracket, to one side of which a day aiming mark (black bullseye on a white background) is permanently fixed. The other side of the bracket provides a support for the night aiming lamp when in use. On the inner rod is a collar and clamping screw which allows this rod to be maintained at a given height when rotated.

By this means the aiming lamp can be set at the same height as the day aiming mark if desired.

3.—Clinometer, Vickers .303-in. M.G., Mark I.

(Plate II.)

1. Description.—This instrument consists of a manganese bronze casting called the "cradle" (A). The upper surface is cut to form the arc of a circle in which the arc (N) can slide, and to the lower surface is attached a cast steel base (B) adapted to rest between the side plates of the gun when the rear cover is raised.

A scale of degrees (C) from zero to 20 degrees elevation and depression is engraved on one face and is read from an arrow (D) on the arc. The graduations for elevation and depression are filled in with black and are numbered every 5 degrees and followed by the letters "E" and "D" respectively.

A worm spindle is fitted in two bearings in the cradle, one end (E) being on a pivot. This allows the worm to be put out of gear with the arc, for quick setting, by pressing downwards on the other end (F) of the worm spindle.

A spring is provided to keep the worm spindle and arc in gear.

Two micrometer collars are fixed to the worm spindle, one (G) for reading depression in minutes, the other (H) for reading elevation in minutes.

The micrometer collars are divided every five minutes and numbered every ten minutes, and are coloured the same as the degree scale. The figures on the micrometer collars have the letters "E" and "D" engraved underneath to indicate elevation and depression respectively.

At one end of the worm spindle a milled head (J) is firmly attached; one turn of this milled head represents one degree.

The arc (N) is shaped to slide in the cradle. On its under surface are teeth into which the worm gears. Attached to it by two screws is an adjustable reader (K) for the degree scale. On its upper surface is attached a spirit-level (L).

Engraved on the base is an arrow (M) and the word "Target." This is to indicate the correct direction in which to place the clinometer on the gun.

4.—Director, No. 4, Mark II.

(For Plates, see Lesson 39).

1. Description.—This instrument consists of:—

(i.) The telescope (which is of the prismatic type and is contained in a rectangular aluminium box (A).

Magnification, 6 diameters;

Field of view, 8 degrees 24'.

Effective aperture of object glass—1.2 inches.

A vertical pointer is mounted in the focal plane of the object glass.

(ii.) The clinometer level consists of a bubble arm, pivoted to the front end of the telescope body and having a worm arc cut on its rear end. A reader for the degree scale is engraved on its rear end.

A bubble spirit glass is mounted on this arm. It can be adjusted by turning a large capstan-headed screw which passes through the front end of the bubble casing.

A worm spindle, having micrometer heads (elevation) and (depression) graduated in divisions of five minutes, gears with the arc on the bubble arm. It is kept up to its work by a flat nickel alloy spring; the micrometers are not adjustable.

A degree scale graduated from ten degrees elevation to ten degrees depression is attached to the telescope body. The graduations of elevation scales are filled with black and those for depression with red. Two projecting pieces protect the bubble from damage.

(iii.) The slider is attached beneath the telescope. It is shaped to fit into the "Stand, No. 4 director."

A flat nickel alloy spring beneath it takes up all up-and-down play between the director and the stand.

The weight of the instrument is two pounds.

The stand consists of:—

(iv.) A tripod having mahogany legs with steel shoes. The legs are hinged to a base plate around the upper end of which the clamping socket can revolve. An anchoring hook, to which a steady weight can be attached, is screwed into the base plate.

The lower end of the clamping socket is roughened so that a good grip of the fingers can be obtained when it is being revolved. The clamping screw, when tightened up, clamps the clamping socket to the base plate.

To the top of the clamping socket is attached, by screws, the degree scale plate. The rim of this plate, which is made of nickel alloy, is graduated in both directions from 0 to 180. "Right" and "Left" are indicated by "R" and "L" beneath each number.

Pivoted to the degree scale plate is the index plate.

A small piece of nickel alloy, upon which an arrow for reading the degree scale is engraved, is let into the plate. Upon the index plate are mounted a "bubble, spirit, cased, No. 1," and a magnetic compass. The needle of the compass can be raised from, or lowered on to, its pivot by means of a slide, which is not shown in the plates. The index blocks of the compass can be adjusted by turning two small screws.

The clamping nut clamps the degree scale plate to the index plate by means of an internal clamping ring.

Attached to the upper surface of the index plate is the carrier bracket, to which is pivoted the carrier. The carrier is shaped to take the base of the No. 4 director. A stop prevents the insertion of the director from the wrong end, and a side spring of nickel alloy takes up side play.

A slow motion elevating gear, consisting of a nut and right and left-handed screws, which are attached to the index plate and carrier, allows the director to be moved smoothly between 25 degrees elevation and 18 degrees depression.

The weight of the stand is eight pounds.

2. To test the director for angle of sight.—This is done as follows:—

(i.) Select a position where there are two walls or upright posts, about 200 yards apart, and as far as possible in the same horizontal plane. (See Diagram, Plate III.).

(ii.) Take the instrument to one wall (A) if possible at the corner of a house. If testing a No. 4, Mark II., director, set the degree and minute scales to zero. (This should not be necessary with a later pattern director.) Now lay the instrument on the other wall, and by means of the elevating gear centralize the bubble.

Look through the telescope and direct someone to mark the point aimed at on a distant wall (B). Mark the wall where you are standing at (A) at the same height as the object glass of the instrument.

(iii.) Take the instrument to the distant wall (B), and place the object glass against a mark (B) made on the wall. In the case of the No. 4, Mark II., director, keep the degree scale to zero. Bring the bubble to the centre of its run by means of the elevating gear.

If the instrument is now found to be laid on the mark (A), it is in adjustment.

(iv.) If it is desired to test more than one instrument it is necessary to obtain a horizontal line.

If, as in sub-para (iii.), above, the instrument is found to be laid on the mark (A), the line joining (B) and (A) is a horizontal line, and it may be used to test other instruments.

If the instrument is found not to be laid on (A), the bubble being central, direct someone to mark the spot on which it is laid (C).

Now make a third mark (D) on the first wall, exactly half way between (A) and (C). This mark (D) in conjunction with the mark (B) will form a horizontal line.

To prove accuracy it is advisable to place the instrument at (D) and check back on (B).

When the horizontal line has been obtained the other instruments can be checked and adjusted on it.

(v.) Having laid out a horizontal line, proceed to test the instrument.

In the case of the No. 4, Mark II., director, set the degree and minute scales to zero. (This is not necessary with later patterns.)

Place the object glass at one end of the horizontal line and lay on the point with the elevating gear at the other end of the line laid out. The bubble should there be central; if it is not, turn the micrometer head until it is so and note the error.

In the case of directors of later pattern than the No. 4, Mark II., it is only necessary to lay on the opposite mark and note that the bubble is central. If the bubble is not central, elevate or depress the telescope until it is so and note the error through the eye-piece.

NOTE.—Where adjustment is necessary, it will be carried out by an armourer.

5.—Sights, night, Vickers .303-in. M.G.

(Plate I.)

i. The foresight consists of a vertical, rectangular, sheet steel plate, $1\frac{7}{8} \times 2\frac{3}{8}$ inches, shaped and pierced to form sighting features, and mounted upon a steel body with spring arms, by means of which it is attached to the protecting wings of the sliding sight of the deflection bar foresight. It can also be attached to the foresight bracket of the gun if required.

The sighting features consist of a barley-corn, formed centrally on the upper edge; below this is an aperture; then a rectangular opening having an inverted barley-corn projecting from its upper edge, and a combined aperture

and blade from its lower edge, whilst a notch is cut in each side to indicate normal limits of traverse, the spacing being equal to about one degree of angle in each direction.

The foresight is assembled to the sliding sight of the deflection bar foresight by being sprung on to the protecting wings from the side which faces the breech of the gun.

ii. The backsight consists of a vertical rectangular steel plate about $1\frac{3}{8} \times 1\frac{5}{8}$ inches, pierced to form a sighting aperture about $\frac{1}{16}$ inch in diameter, and below, to the right and left of the aperture, two small rectangular openings behind which a background of luminous paint can be employed if required as a guide to the position of the aperture.

The plate is secured to a small steel body, to which is attached a spring clip for engagement with the tangent sight slide of the gun.

The backsight is assembled to the slide by pressing it on to the projecting blade portion from the left, care being taken to see that the horizontal ledge of the body rests on the upper edge of the blade, and that the bent lip on the right side of the spring engages over the inner edge of the slide.

6.—Lamps, aiming, M.G., Mark II.

1. Description.—

The lamps are contained in a wooden box, there being two lamps in each box. On the side of the box is a folding handle.

In the lid of the box is a drum on which is wound a separate cable for each lamp. This drum is operated by the folding handle.

In the box is the battery and a spare battery, held in place by an ebonite strip and a screw. On the side of the compartment for the batteries is an adjustable resistance for regulating the amount of light shown by the lamps.

Next to the batteries is the switch. Either lamp can be illuminated by moving the switch to one of the points marked 1 and 2 on either side of the "Off" position.

Both can be put on together by moving the switch to the point opposite the "Off," also marked 1, so that the switch covers that point and also that marked 2.

Next to the switch is a block of wood with two holes to take spare bulbs. A hole is cut in the side of the box so that the lid can be closed when the cable is out and the lamps ready for use. Two spare batteries for the lamps are carried in addition to those in the box.

2. Instructions for the care and use of Lamps, aiming, M.G.

i. Before the box is opened, the folding handle of the

drum is to be opened out ready for use. This is important, as if the handle is left folded the cable is liable to be pulled away from the connecting screws of the terminal plates of the lamp.

ii. When the lamp is not in use, care should be taken to ensure that the switch is left at "Off" and quite clear of "1" and "2."

iii. No projecting strands of wire should be allowed to touch any terminal other than that to which they are attached. Particular care should be taken to prevent any exposed wire from touching the terminals of the spare cell.

iv. The folding handle of the drums should be restored into its slot when the box is closed for travelling.

v. When the cable is being unwound, both wires should be unwound together. Speed should not be attempted. The lamps should not be held in the hand, but by the wire about a foot from the lamp. Neglect of this precaution may result in the lamp being jerked and the connection carried away should the cable jam on the roller.

During unwinding, the man at the box should take care that no loose coil of cable is allowed to loop round the ends of the roller.

vi. When the cable is being wound in, the following procedure is the simplest. The man should hold the body of the box between his knees, turn the handle with his right hand and with his left hand lead the two cables, held as a double cable, regularly across the drum. Regularity in winding-in is essential to ensure that the cable can be instantly unwound when required.

vii. The coil of the adjustable resistance should be kept free from knocks and kept in its seating.

viii. When in the box, the lamps are placed back to back on two iron pegs. The word "Top" on the lamps indicates the position when on the target post, not when in the box.

ix. When the cells are being placed in position it may be necessary to cut the cardboard edge in order to give the ebonite securing strip a good seating on top of the cells.

7.—Angle of Sight Instrument, Mark II.

(Plate IV.)

NOTE.—Plate IV. is of angle of sight instrument, Mark I.—the only difference between the Mark I. and Mark II. is the base plate H—the Mark II. having a gunmetal slide in lieu of the aluminium plate in the Mark I.

(A.) DESCRIPTION.—

1. The instrument consists of a brass box forming a prismatic telescope, the eyepiece of which is so arranged that besides the view a spirit bubble together with a vertical and a horizontal cross line can be seen. These two lines intersect each other at the centre of the field of view. The bubble can be inclined to the line of sight and the inclination read off degree and minute scales:—

Magnification—4 diameters

Field of view—4 degrees horizontal by 5 degrees 30 mins. vertical.

Weight of instrument in case—1 lb. 8 ozs.

Overall dimensions of case—5½ ins. by 4 ins. by 2½ ins.

2. It consists of the following parts:—

The brass body (A) is fitted internally with guides for the supporting plate (B). A flap (C) is hinged to the rear end and holds the eyepiece adapter (K) and eyepiece (D). It is kept in position by the screw (E). A glass window (F) admits light to the bubble. The two serrated discs (G) are for the fingers of the left hand to rest on, when taking angles. A light gunmetal slide at (H) is fitted to the base of the instrument, which enables it to be mounted on the Stand, No. 4 Director, Mark I. It can then be used as a director for measuring angles in horizontal and vertical planes.

The object glass is mounted in front of the body and a ray shade (J) fits over it. It consists of two lenses balsamed together, and is adjusted so that the vertical and horizontal cross lines on the prism (M) are in its focal plane.

The eyepiece (D) fits in the eyepiece adapter (K), and is focussed by sliding it backwards or forwards, and not by twisting it. It has two lenses, the front one is cut away for a third of its breadth so that the view, which is seen through both lenses, and the bubble, which is seen through the rear one only, are in focus simultaneously.

The supporting plate (B) fits accurately in the guides in the body. A small projection (B₁) is formed on it to facilitate withdrawal.

On the left side are mounted two double reflecting prisms (L, M), the latter having a vertical line and a horizontal cross line engraved on its rear surface, and a mirror (N) in which the reflection of the bubble is seen.

A pivot passes through the plate, and on it are mounted a cased spirit bubble (O) and an arc (P). The bubble, which is sensitive to a movement of between 4 mins. and 5 mins. is supported on the bubble bracket (Y) by two screws, which allow of it being adjusted if the degree and minute scales do not correspond. The

arc has teeth cut on it, which gear with the worm spindle (Q), and a projection (P), on which an arrow for reading the degree scale is engraved.

Play is taken up by the spiral spring (R).

Attached to the plate is the degree scale (S) with graduations in single degrees from 0 degrees to 15 degrees elevation and 10 degrees depression, the latter being filled in white on black.

The worm spindle (Q) is fitted in bearings, and is squared at its upper end to take the milled head (T), beneath which is an adjustable skin (U). The latter is graduated every 5 minutes, numbered every 10 minutes in both directions, and coloured to agree with the degree scale. It can be loosened for adjustment by slackening the two screws (V).

3. Case.—The leather case is suitably fitted and padded and has a shoulder strap fitted to it.

4. Earlier Patterns.—Certain early patterns of this instrument differ from the Mark II. in that the base plate (H) does not permit of the instrument being mounted on a director stand, and in some instances the degree scale (S) reads from 15 degrees elevation to 5 degrees depression, and the case is not padded.

5. To take an Angle of Sight.—Mount the instrument on the director stand. Focus the instrument by sliding the eyepiece backwards or forwards. Loosen the "butterfly-shaped" clamping screw on director stand. Lay the intersection of the cross-wires by means of the elevating gear and milled portion of the clamping socket on the director stand, at 6 o'clock on the target.

Turn the micrometer head (T) with the right hand until the centre of the bubble is opposite the right end of the horizontal line etched on the large prism.

Read the angle of sight off the degree scale (S) and the corresponding minute scale (U).

Angles of sight may be taken holding the instrument in the left hand if a director stand is not available. It is advisable to rest the instrument, if possible, to obtain steadiness. Take the mean of three readings under such conditions.

6. To Measure a Lateral Angle between Two Points.—Set the pointer on the index plate of the director stand opposite "ZERO" on the degree scale of the stand.

Tighten up the clamping nut. By means of the elevating gear and milled portion of the clamping socket lay the intersection of the cross wires at 6 o'clock on the first point. Tighten up the "butterfly-shaped" clamping screw on the director stand.

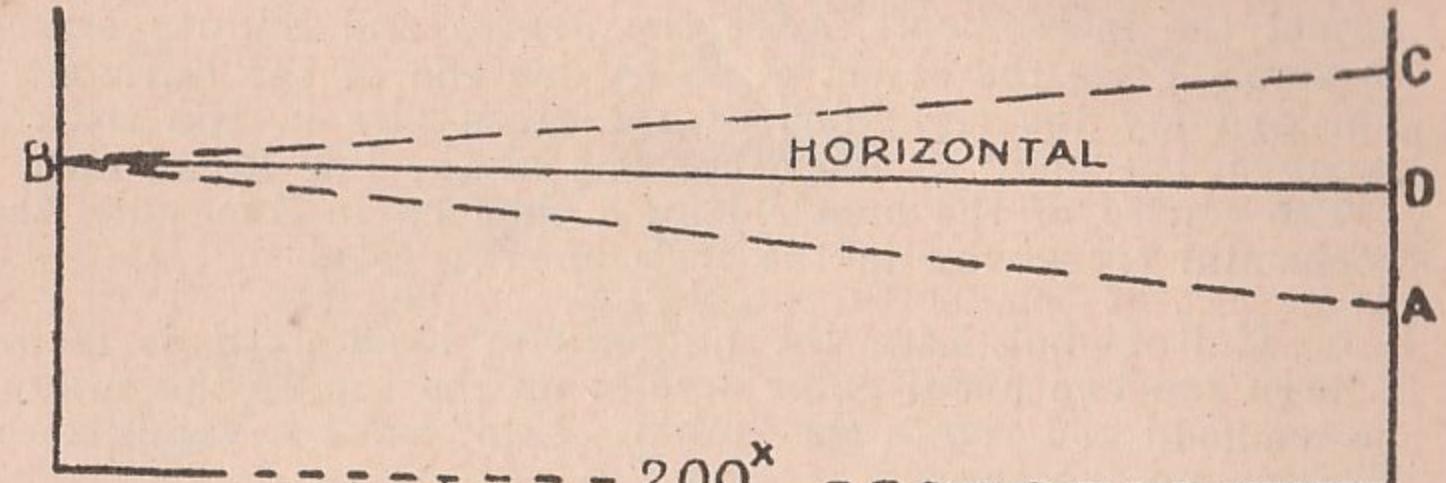
Loosen the clamping nut and lay the cross wires on the second point.

Read off the number of degrees, minutes, and direction, right or left, from the degree scale. For further details, see Lesson 39, where, although the detail refers particularly to the director, No. 4, Mark II., the method of use is similar when employing an instrument, angle of sight.

(B.) TO TEST AND ADJUST THE INSTRUMENT.

1. Lay out a horizontal line. This is done as follows:—

(i.) Select a position where there are two walls or upright posts, and about 200 yards apart, and as far as possible on the same horizontal plane.



(ii.) Take the instrument to one wall (A), if possible at the corner of a house. Set the angle of sight scale to zero, direct the telescope at the other wall and bring the bubble to the centre of its run. Look through the telescope and direct someone to mark the point where the cross-wire cuts through the distant wall (B). Mark the wall where you are standing at (A) the same height as the object glass of the instrument.

(iii.) Take the instrument to the distant wall (B) and place the object glass against the mark (B) made on it. Still keeping the angle of sight scale at zero, bring the bubble to the centre of its run. If the instrument is in adjustment the cross-wire should be in line with the mark (A) on the first wall and the line between the two marks is in a horizontal plane.

(iv.) If such is not the case direct someone to mark on the first wall (A) another point (C) on which the cross-wire is laid, the bubble being central.

(v.) Make a third mark (D) on the first wall exactly halfway between (A) and (C).

(vi.) With the instrument still at (B) on the second wall elevate or depress the telescope until the

cross-wire is laid on the third mark (D). While keeping it laid on this point rotate the micrometer head of the instrument until the bubble is again in the centre of its run.

(vii.) Without altering the readings take the instrument to (D) and check the adjustment back on (B). If correct, a line between these marks is in the same horizontal plane.

When once a horizontal line has been obtained any number of instruments can be checked and adjusted on it.

2. Having now laid out a horizontal line, proceed to adjust the instruments. Set the degree and minute scales to zero. Place the object glass at one end of the horizontal line and lay the right end of the cross-wire in the instrument on the point at the other end of the line laid out.

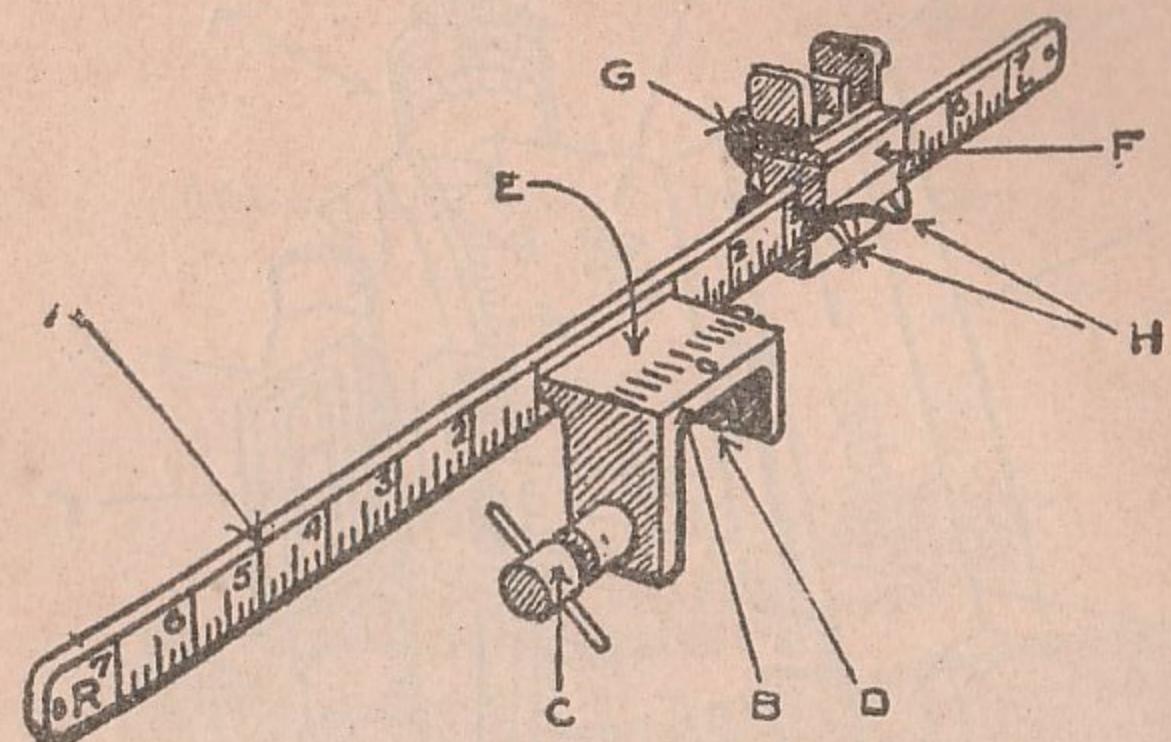
The centre of the bubble should then be in line with the horizontal cross-wire in the instrument.

3. If it is not, turn the micrometer head until it is so. Loosen the two small outer screws on the top of the micrometer head and rotate the "minute skin" until it reads zero. Tighten up the screws.

4. If the degree scale is found to be more than a few minutes off zero, it will be necessary to start afresh and manipulate the screw supporting the cased bubble until, the scales being at zero, the horizontal cross-wire in the instrument is laid on the distant point in the same horizontal plane, and at the same time is opposite the centre of the bubble.

This is a delicate operation and can only be carried out by an expert, as there is danger of damaging the mechanism and smashing the bubble glass.

FORE-SIGHT, BAR, DEFLECTION, Mk. I.



SIGHTS, NIGHT.

FORE.

BACK.

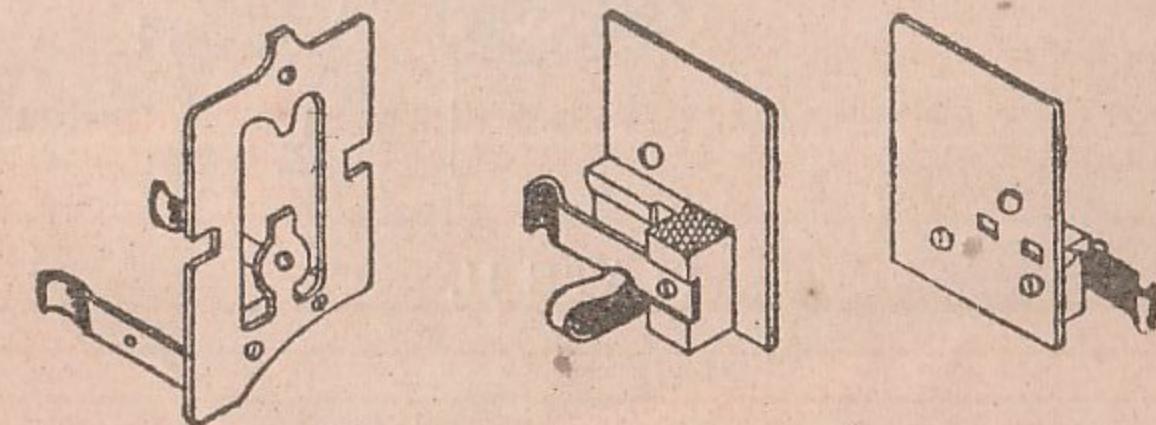


PLATE I.

CLINOMETER, VICKERS .303-IN. M.G., Mk. I.

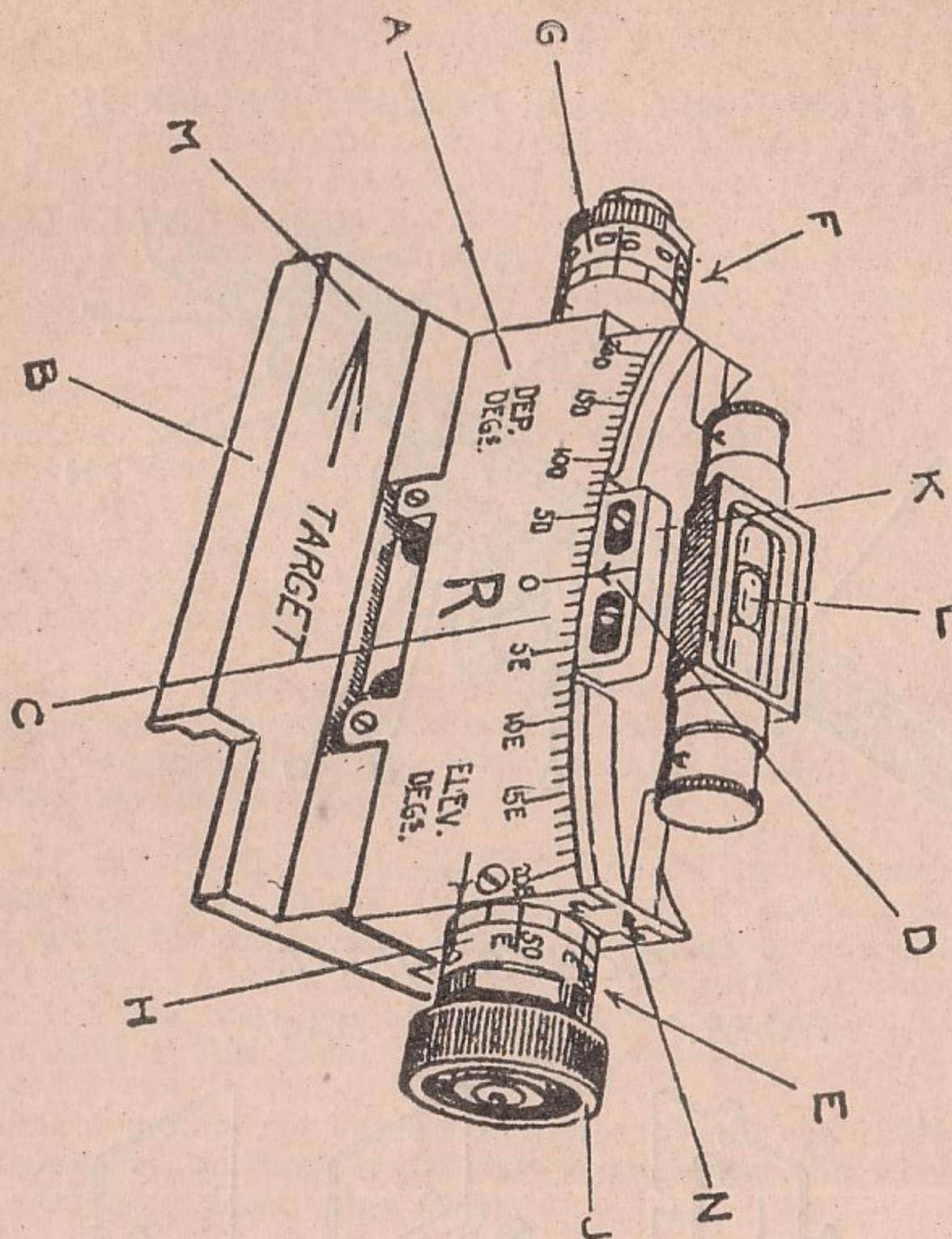


PLATE II.

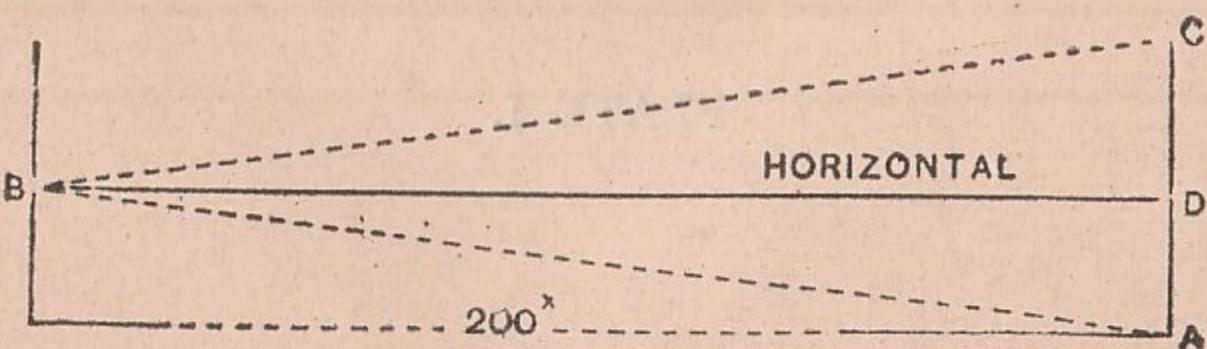


PLATE III.

ANGLE OF SIGHT INSTRUMENT

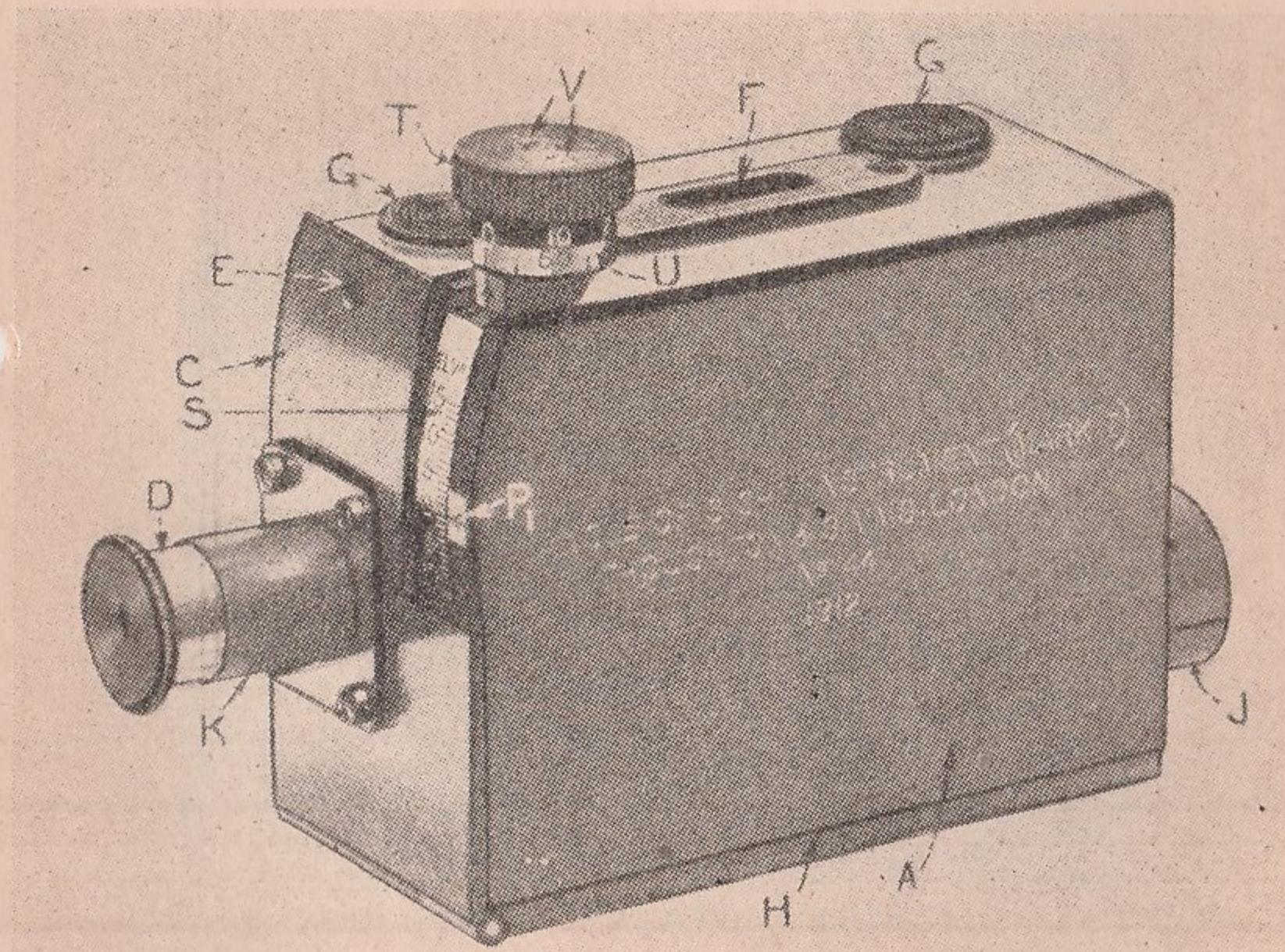
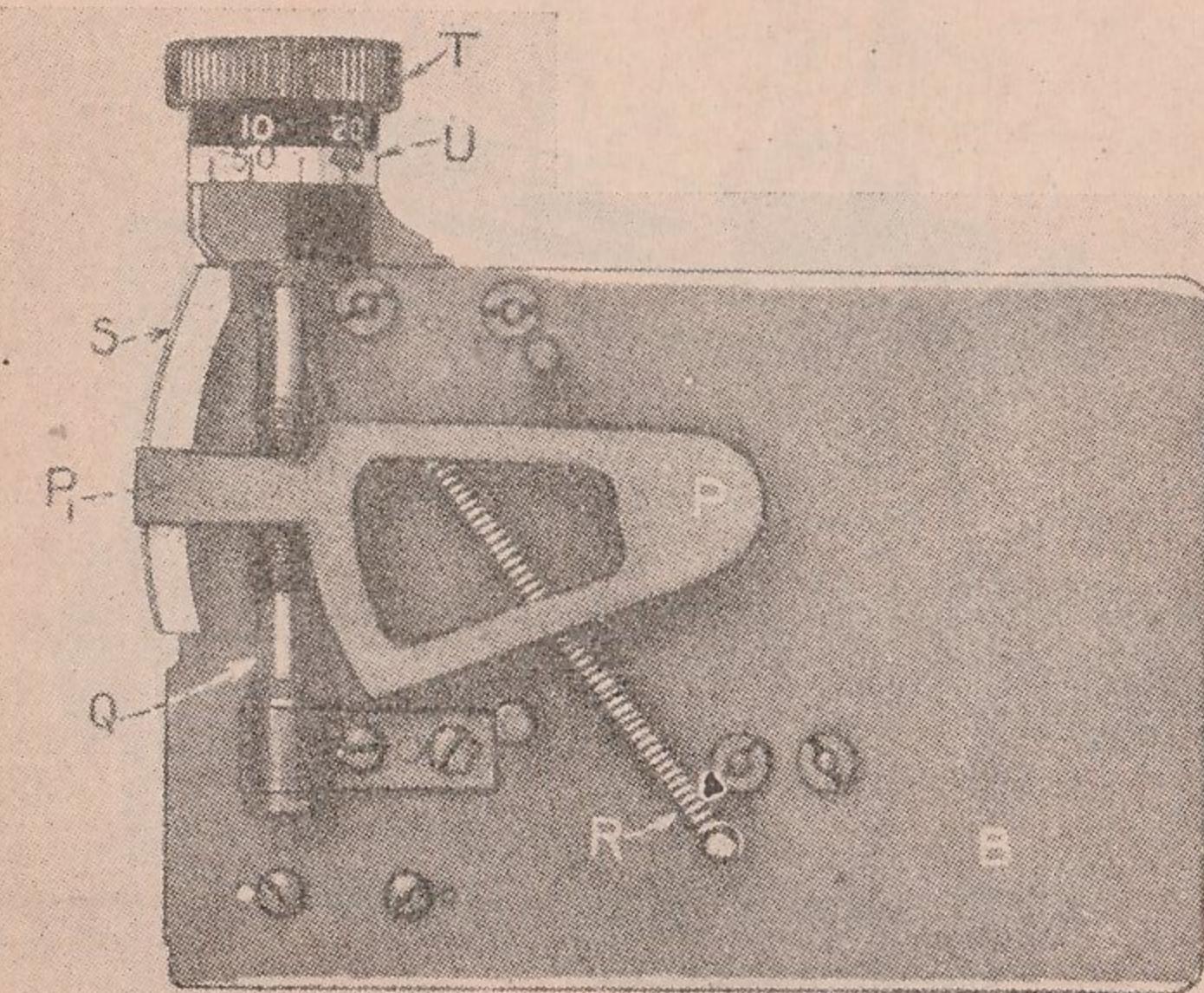


PLATE IV.

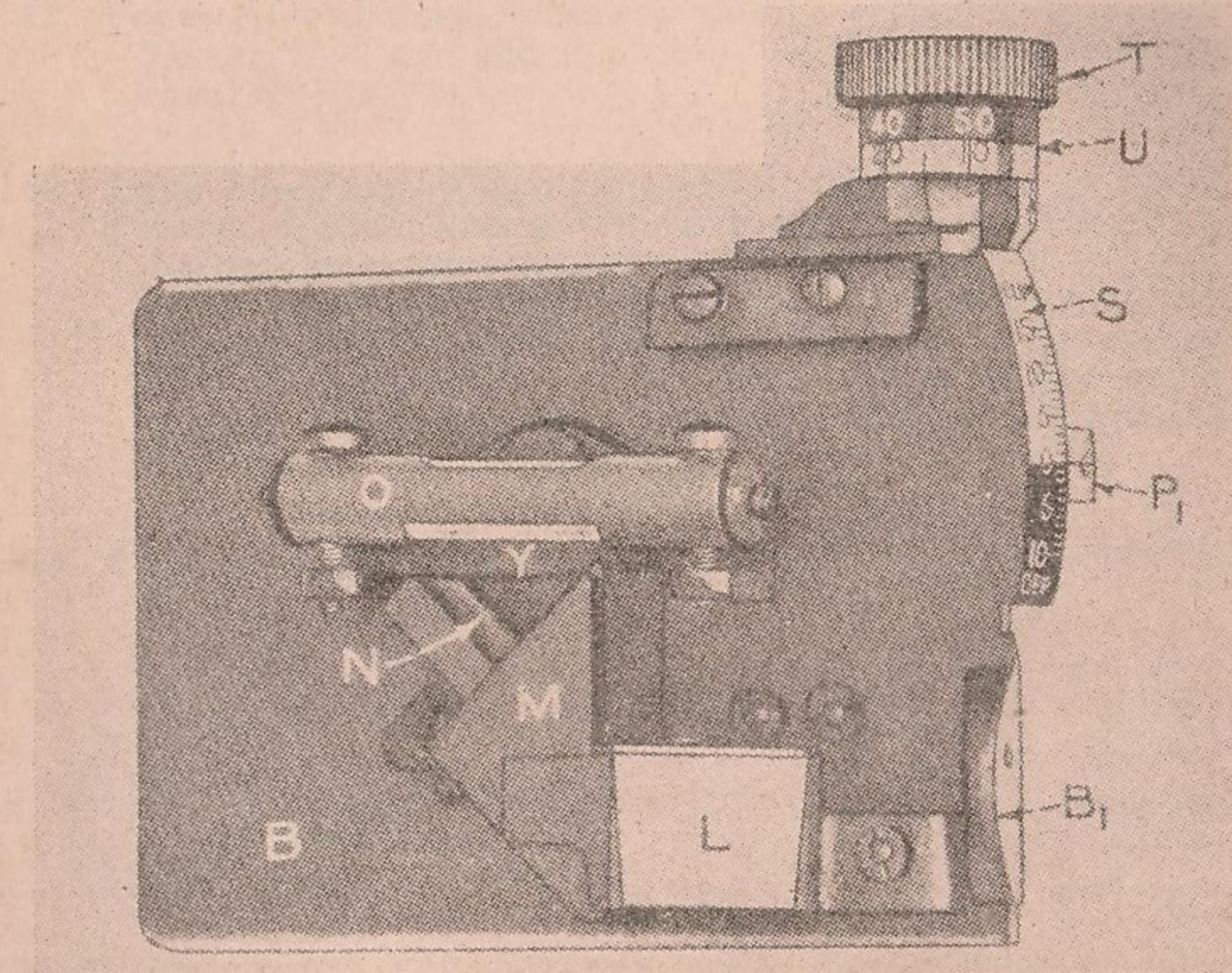
PLATE IV. (Continued)

ANGLE OF SIGHT INSTRUMENT (Continued)



SUPPORTING PLATE, RIGHT SIDE

PLATE IV. (Continued)



SUPPORTING PLATE, LEFT SIDE

AMENDMENTS TO S.A.T., Vol. I.
Pamphlet No. 7, Part I.

Published with Supplement to above Pamphlet.

9. Page 5—B, Organisation, para. 2, lines 1 and 2, delete “or warrant officer, Class III;” para. 2, line 9, after “Batman” add “Two Drivers M.T.”
10. Page 6—C, System of Training—below heading, insert Note: “NOTE—Certain details contained in this Section are not applicable to the A.M.F.”
11. Page 34—against “Screws, clamp, checking traverse” insert “+” and add Footnote “+ Not on Peace equipment.”
12. Page 36—Para. 6, 2nd line—delete “lock home or the;” para. 9, 2nd line, after “extractor” add—“Should it become necessary to remove a cartridge from the face of the extractor, the lock will be removed from the guides in the side plates, care being taken to ensure that the extractor is kept down, the cartridge being moved off the extractor before the lock is changed (or replaced in the guides).”
13. Page 4—delete “Distribution” and relevant detail thereto.



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